

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
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**NRC REGULATORY ISSUE SUMMARY 2022-02
OPERATIONAL LEAKAGE**

ADDRESSEES

All holders of operating licenses and combined licenses for nuclear power reactors, except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

INTENT

The U.S. Nuclear Regulatory Commission (NRC) staff is issuing this regulatory issue summary (RIS) to clarify the requirements to address operational leakage in nuclear power plants. This RIS requires no action or written response on the part of an addressee.

BACKGROUND INFORMATION

Operational leakage from American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV Code) Class 1, 2, and 3 structures, systems, and components (SSCs) is a special case in technical specifications (TS) that the NRC staff has determined needs to be clarified for nuclear power plant licensees. Operational leakage is a safety concern due to the unknown condition of the component when leakage is identified. An SSC exhibiting operational leakage could be vulnerable to structural concerns. The requirement for maintaining structural integrity is a fundamental assumption used in the development of the TS under Title 10 of the *Code of Federal Regulations* (10 CFR) 50.36, "Technical specifications." TS are derived from safety analyses that assume ASME BPV Code Class 1, 2, and 3 components continue to have structural integrity during operation.

For other conditions (for example, a pump failing or a relief valve sticking open), the impact on operability (i.e., the capability of the SSC to perform its specified safety function) is readily evaluated. In contrast, leakage from ASME BPV Code Class 1, 2, and 3 SSCs does not provide a clear indication for understanding the impact of the condition on the system's operability. Operational experience has shown that a small leak may be the first and only indication of a significant degradation issue that could challenge the structural integrity of a component. Several degradation mechanisms, such as stress corrosion cracking, thermal fatigue, flow accelerated corrosion, and general corrosion, can lead to a system being vulnerable to structural concerns while exhibiting only a limited indication of leakage. The NRC staff relies on operational leakage detection as a key defense-in-depth measure to identify potential degradation concerns in these SSCs. Typically, under Section XI when a flaw is visually identified, IWB/C/D-3000 provides acceptance criteria and options for licensees to allow continued service of a component. For example, in recent editions of Section XI, no flaw in ASME Class 2 or 3 piping can remain in service if it exceeds 75 percent through wall per IWC/D-3642. Additionally, in IWX-4000 of Section XI of the ASME BPV Code, specific

requirements are provided to address defects to ensure structural integrity for ASME BPV Code Class 1, 2 and 3 SSCs. For these reasons, licensees are required to effectively evaluate leakage to determine the impact to SSC TS operability.

Through 10 CFR 50.55a(g), the NRC has required the use of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the ASME BPV Code. Section XI provides methods to address leakage from these SSCs, and the NRC has found that the methods in Section XI provide reasonable assurance of the structural integrity of SSCs and hence the operability of the system.

The regulatory requirement of 10 CFR 50.55a(g) and TS, clarified by this RIS, is that structural integrity must be ensured for an ASME BPV Code Class 1, 2, or 3 component that is required to be operable according to the TS, and the only approved methods for doing so are provided in the ASME BPV Code, as incorporated by reference in 10 CFR 50.55a, "Codes and standards." The ASME Code offers multiple methods to meet this requirement, including a series of ASME BPV Code Cases (e.g., N-513, N-705) and Nonmandatory Appendix U, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Piping and Class 2 or 3 Vessels and Tanks," to ASME BPV Code, Section XI. These methods provide specific allowances for leakage from Code Class components to demonstrate that they continue to meet their specified safety function provided that structural integrity is maintained. The NRC staff has reviewed and, in most cases, approved these measures.

The NRC staff has communicated these requirements to licensees in Generic Letter 90-05, "Guidance for Performing Temporary Non Code Repair of ASME Code Class 1, 2, and 3 Piping," dated June 15, 1990 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML031140590), and through RIS 2005-20, "Revision to NRC Inspection Manual Part 9900 Technical Guidance, Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety" (ML052020424), which has been revised twice (Revision 1, dated April 16, 2008 (ML073440103), and Revision 2, dated June 5, 2015 (ML15106A484)). In addition, the NRC staff's position is documented in inspection criteria for these requirements in NRC Inspection Manual Chapter 0326, "Operability Determinations," and Inspection Manual Part 9900 Technical Guidance, "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety" (ML031140549 and ML19273A878). The NRC staff thoroughly documented its positions on these issues in a series of letters written in 1996 (ML20006H277 and ML20112K084). In these letters, the NRC staff explained that 10 CFR 50.55a(g)(4) provides the regulatory requirement to address leakage in components, within the scope of 10 CFR 50.55a, during operation. Further, the NRC staff clarified that ASME Code interpretations are not a part of NRC regulations, that the NRC is responsible for ensuring that 10 CFR is effectively implemented, and that alternatives must be reviewed and approved by the NRC staff before being used by a licensee.

Despite these communication efforts and inspection activities, the NRC staff is aware that confusion exists over differences between the provisions of the ASME BPV Code and the requirements in NRC regulations. ASME has stated through ASME BPV Code Interpretations XI-1-92-03 and XI-1-92-19 (Question 2) that the corrective actions specified in ASME BPV Code, Section XI, paragraph IWA-5250, are not required by the ASME BPV Code to be implemented when leakage is found outside of the performance of an ASME BPV Code required pressure test and visual examination for leakage (VT-2) examination. As noted above, the requirements of 10 CFR 50.55a and plant TS require that the same ASME BPV Code methods for evaluating structural integrity be used whether the leakage is discovered during an

ASME Code required pressure test and VT-2 examination or by other means (e.g., plant walkdowns) as operational leakage. Essentially, regardless of when and how leakage is detected in these SSCs, the same ASME BPV Code methods for evaluating structural integrity must be used when failure of the SSC could affect system operability, and actions in accordance with plant TS may need to be initiated.

SUMMARY OF ISSUE

Given the potential confusion between NRC requirements and ASME Code interpretations, the NRC staff seeks to clarify that 10 CFR 50.55a(g) includes regulatory requirements that apply to operational leakage for all licensees of boiling and pressurized water reactors. This RIS clarifies the NRC requirements for evaluation, control, and treatment of operational leakage in systems required to be operable by plant TS.

Operational leakage is leakage through a flaw in the pressure retaining boundary of an ASME BPV Code Class 1, 2, or 3 SSC discovered during the operational life of a nuclear power plant outside an ASME BPV Code required pressure test. The term “through wall” describes a condition that extends from one surface to another surface in a component. If through wall operational leakage is observed from an ASME BPV Code Class 1, 2, or 3 SSC and the structural integrity of the SSC must be established to conclude that the system remains operable, then the methods described in the provisions of the applicable inservice inspection requirements, as specified in 10 CFR 50.55a(g), must be used. These methods require performance of a repair/replacement activity in accordance with the original construction code or ASME BPV Code, Section XI, or implementation of an NRC approved substitute for the repair/replacement activity (e.g., Code Case N-513, alternatives under 50.55a(z)) to verify structural integrity.

To clarify, the language in the preceding paragraph, “and the structural integrity of the SSC must be established to conclude that the system remains operable,” is linked to the entry into a TS action statement. Licensees are allowed to evaluate the location to determine if the leakage affects the structural integrity of an SSC governed by TS. If operational leakage is from a component that does not need to maintain structural integrity for a system to perform its specified safety function, and the leak does not impact the ability of other SSCs governed by TS to perform their specified safety functions, then the leakage can be addressed through other processes (e.g., corrective action program). For example, if the licensee identifies leakage from a drain line, the complete failure of which would not affect operability of any system (e.g., complete failure will not result in loss of adequate flow in the main system, will not result in room flooding that could result in loss of a specified safety function, etc.), then the requirements discussed in this RIS would not apply. In contrast, any degradation in the main line of a system can challenge the structural integrity of that system and that system’s specified safety function. This requires further action as identified in this RIS to demonstrate operability. Additionally, for leakage in ASME Class 1 systems, this condition is governed by the leakage allowances of the applicable TS, and any pressure boundary leakage requires repair of the reactor coolant pressure boundary, in accordance with this RIS.

This RIS emphasizes that operational leakage must be addressed in the same manner as leakage detected during an ASME BPV Code, Section XI, pressure test. Structural integrity determinations of the leaking component must be conducted in accordance with the applicable provisions of the original construction code or ASME BPV Code, Section XI. However, through-wall leakage does not meet the acceptance criteria of either the construction codes or Section XI, except when certain ASME Code Cases are applied. Thus, when operational

leakage is found in a system that is within the scope of ASME BPV Code, Section XI, and that system is required to be operable by plant TS, the licensee must perform an ASME BPV Code repair/replacement or an NRC-approved substitute for repair/replacement (e.g., Code Case N-513). Other methods for deferring repair/replacement can be authorized as alternatives under 10 CFR 50.55a(z), "Alternatives to codes and standards requirements" (Generic Letter 90-05 is an example of guidance on one method that can be authorized).

Alternatives under 10 CFR 50.55a(z) can be used as long as NRC staff authorization is granted before implementation. Implementation is deemed to be the moment that the structural integrity of the component is required to be established (e.g., before expiration of the TS allowed completion time). Licensees can avail themselves of the alternative process to propose evaluation methods or repair/replacement activities to resolve any circumstances that are not addressed by NRC-approved ASME Code evaluation methods.

For nuclear power plant licensees authorized to implement 10 CFR 50.69, "Risk informed categorization and treatment of structures, systems and components for nuclear power reactors," the discussion in this RIS applies to Risk Informed Safety Class (RISC)-1 and RISC-2 categorized components that are required to be operable by plant TS because 10 CFR 50.55a(g) continues to apply in full to RISC-1 and RISC-2 components. The NRC regulations in 10 CFR 50.55a(g) also continue to apply to those RISC-3 or RISC-4 categorized components classified as ASME BPV Code Class 1 and are required to be operable by plant TS. Operational leakage in RISC-3 or RISC-4 categorized components that are classified as ASME BPV Code Class 2 and 3 and are required to be operable by plant TS must be treated in accordance with the licensee's approved 10 CFR 50.69 requirements. The NRC regulations in 10 CFR 50.69(d)(2)(i) require that, at a nuclear power plant implementing a 10 CFR 50.69 program, periodic inspection and testing activities must be conducted to ensure RISC-3 SSCs remain capable of performing their safety related functions under design basis conditions. The Commission provides information for the implementation of 10 CFR 50.69 in "Risk-Informed Categorization and Treatment of Structures, Systems and Components for Nuclear Power Reactors" (69 FR 68008; Nov. 22, 2004).

BACKFITTING, FORWARD FITTING, AND ISSUE FINALITY DISCUSSION

This RIS clarifies the existing requirements for operational leakage. It does not present a new or changed NRC staff position, nor does it require any action or written response from any addressee. Therefore, issuance of this RIS is not a backfit under 10 CFR 50.109, "Backfitting," nor does it affect any issue finality provision in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." Further, the NRC staff does not intend to impose this RIS on applicants in a way that would constitute forward fitting as that term is defined in Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests."

FEDERAL REGISTER NOTIFICATION

The NRC published a notice of opportunity for public comment on this RIS in the *Federal Register* (2022-00686) on January 14, 2022. The agency received comments from seven commenters. The staff considered all comments, which resulted in changes to the RIS. The evaluation of these comments and the resulting changes to the RIS are discussed in a publicly available memorandum which is in ADAMS under Accession No. ML22167A003.

CONGRESSIONAL REVIEW ACT

The NRC has determined that this RIS is not a rule, as defined in the Congressional Review Act (5 U.S.C. §§ 801–808).

PAPERWORK REDUCTION ACT STATEMENT

This RIS may contain new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.) but not covered by an existing clearance. In addition, the RIS cites guidance documents that are not in compliance with the mandatory standards in 5 CFR 1320. Some of the existing requirements were approved by the Office of Management and Budget (OMB) under approval number 3150-0011.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, an information collection unless the requesting document displays a currently valid OMB control number.

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Please direct any questions about this matter to the technical contact(s) or the lead project manager listed below.

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Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under NRC Library/Document Collections.

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